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AUTHOR Maier, Esther
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ABSTRACT

Because a need existed for better articulation between the metal trades programs offered at area high schools and at Blackhawk Technical Institute in Janesville, Wisconsin, a program of communication with the high schools was developed. This communication was expected to lead to a smoother transfer of students from one level of training to another, to establish a common element or core curriculum, and to serve the needs of industry in a more credible manner. During the project, a master list of machine shop/general metals competencies was drawn up, standards for core competencies were determined, a rating scale for evaluation of competencies was established, and a competency certificate to be used by students as a communication link between training programs and with future employers was designed. In addition, contact between educational levels was enhanced and career awareness among women about machine shop trades was promoted. Products created by the project included the competency-based curriculum, agendas for workshops that were presented in the area, and a slide-tape presentation aimed at young women. (Appendixes, which make up the bulk of this document, contain workshop letters and agendas, the final competency record document, and the machine tool trades slide-tape script.) (KC)

MACHINE TOOL - METALS TRADES COMPETENCY CERTIFICATE

FINAL REPORT
ARTICULATION
PROJECT 05-928-150-311
MAY, 1981

BLACKHAWK TECHNICAL INSTITUTE
P.O. BOX 5009
JANESVILLE, WI 53547

CURRICULUM ARTICULATION

PROJECT NUMBER

MACHINE TOOL TRADES

WORKSHOP PROJECT

RESULTS and

DESCRIPTIVE REPORT

Submitted by

Esther Maier
Curriculum Coordinator

Blackhawk Technical Institute

June, 1981

ACKNOWLEDGEMENTS

Traditionally, the metal trades have been a vital part of the economy in the Blackhawk Technical Institute District. This results in a heavy demand on local secondary and post-secondary training programs to provide quality education for future metals workers.

Therefore, the opportunity to cooperatively establish a working curriculum in Metal Trades Occupational Programs within the District was readily agreed to by both high school and Blackhawk Tech instructors and administrators. A sincere thank you to these professionals for their fine work.

A special thank you to the advisory committee members of the various programs for their advise and guidance.

And a grateful thank you to the WBVTAE for supporting the project and providing the funds.

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INTRODUCTION

The metal trades are a vital part of the Blackhawk Technical Institute District economy, and the labor force required to man this important industry must be highly skilled. Machine tool operator training programs in the District have become "staple" programs and are of great interest and concern to local industry and community personnel.

Career exploration of the metal trades is begun in grades seven through nine. Public school students are offered career awareness courses as early as the junior high grades which are followed by high school level courses in metal working and metal trades.

One area high school contracts for services from Blackhawk Tech for a metals trades course; this offering has been highly successful and fully supported by the high school community.

Blackhawk Tech has two full-time metal trades programs; Machine Tool Operator and Machine Maintenance. STIP CETA class-size projects have been developed from these two vocational level offerings as have integral parts of other CETA programs.

Training programs for local industry fill available shop time, and as a result, the classrooms and shops are often busy from early morning until late at night.

Students come to the Blackhawk Tech programs from a variety of

training levels, both from formal training and from work experience. Understanding students' capabilities and their future needs is of major importance at the post-secondary level in providing adequate learning experiences. Secondary level programs are also concerned that students be given career awareness and a basic understanding of this respected and vital industry.

Statement of the Problem

Articulation among various levels of metal trades programming had not been approached, although this occupational field is of great interest in the community. An understanding of the knowledges, skills, and attitudes needed to enter this field was not being shared by area institutions involved in such training.

In discussion with both VTAE and DPI consultants, the staff at Blackhawk Tech agreed that it was necessary to begin communicating with area schools in developing a competency based, core curriculum for the metals trades. This would provide a smoother transfer of students from one level of training to another, would establish a common element or core curriculum, and would be answering industry's needs in a more credible manner.

Project Activities

The project objectives were then translated into the following activities, and a time frame for these activities was determined.

A. October 16, 1980

First dinner meeting of program instructors to establish objectives and time frame and to begin competency list research. (Appendix B)

B. November 12, 1980

Determine major task categories for competency list. Select format for certificate. (Appendix C)

C. December 2, 1980

Arrange sub-competencies under major categories, select rating scale. (Appendix D)

D. February 11, 1981

Final review of competency list, certificate format, and rating scale. Advisory committee members included at this time. (Appendix E)

Project Catalysts

The DPI Industrial Education Consultant had made previous contacts with local high school instructors and LVECs. His report was favorable as to the potential for an articulation activity among the secondary schools and Blackhawk Tech. VTAE research state consultants further supported the proposed plans.

Objectives were written and a proposal developed that were then presented to Blackhawk Tech staff and the DPI consultant. It was agreed to submit the proposal to WBVTAE for funding. The project and monies were approved. (Appendix A)

Project Objectives

In order to establish a communication link and to further competency-based curriculum among area programs, the following objectives were established as a bases for an Articulation Metal Trades Project for the winter and spring of 1980-81.

1. Develop master list of machine shop/general metals competencies drawing from research and materials now in use from V-TECS in other state programs.
2. Determine standards for core competencies whenever possible.
3. Establish a rating scale for evaluation of competencies.
4. Design a competency certificate to be used by the student as a communication link between training programs and with future employers.
5. Obtain advice and support from advisory committee members as representatives of industry and future employers as to the

effectiveness of the certificate.

6. To develop and maintain professional contact between levels that will further enhance positive interchange of instructional staff.

7. To develop career awareness among women in the non-traditional area of the machine shop trades.

October 16, 1981

Letters were sent to the administrators of area high schools having metals and metal trades courses or programs requesting permission for the program instructor to attend the series of articulation workshops. The objectives were explained as was the projected final result--a competency certificate.

Nine area high schools were represented, three area LVECs, and a consultant from DPI.

The project objectives were described. Plans were made as to determining the competency/task list. Blackhawk Tech instructors agreed to gather resources and curriculum materials already developed to establish a master list. The master list would be revised to suit the articulation activities.

November 12, 1980

The selected competency list of job tasks presented to the group by the Blackhawk Tech. staff had been developed through the following resources:

1. Instructor-identified tasks
2. V-TECs Machinist Catalog
3. District One Machine Tool Articulation Project
4. Metals Trades Apprenticeship Curriculum Project
5. Machine Tools and Machining Practices; White, Warren T. et al.

The competency list had been previously used to profile a CETA class-sized project for a machine tool operator program. It was this categorization and listing of sub-competencies that would be reviewed and revised.

At least one-half of the list was carefully scrutinized. Categories were considered for scope and sequence. Revisions, deletions, and additions were made. The careful, fine tuning of the list took time. Much information was shared in the process and a better understanding of the various courses and programs began to develop.

A rating scale was discussed and written for later consideration.

The next meeting date was selected and it became apparent that the work would take at least two more meetings instead of just the one remaining as scheduled.

December 2, 1980

The members of the workshop reviewed the work completed at the last meeting. The rating scale was approved and established as written. A format for the certificate was selected and was patterned basically from the CETA programs.

The remainder of the meeting was spent in revising the second half of the competency categories and specific items under each. Again, the group carefully determined content.

As outlined in the project objectives, the final meeting was to include advisory committee members from both high school and Blackhawk Tech programs. This would give the instructors an opportunity to share the resulting competency list with employers and to receive their advise and guidance in preparing the competency certificate.

The finalized list was then to be typed for distribution at the last meeting.

February 25, 1981

The advisory committee members were introduced to the group, and the participants explained the articulation activities and objectives to the advisory members. The finalized list of competencies were shared and discussed.

Details of the record were established such as the need for a disclaimer statement, wording used on the record, hours of attendance to be recorded, and the use of the instructors' signature to indicate the evaluator.

After discussion with the advisory committee members, the certificate was approved; and it was agreed to prepare it for printing. Each participating instructor would receive copies as soon as they were available.

Slide-tape Presentation

During the previous sessions and especially as a part of the final meeting, the need to reach all students on the benefits of a metal trades profession was apparent. Students must be made "career aware" as early as junior high. Courses and programs must be available that keep the interest high. Employers recognize the need to keep training at a high level, also.

All, both educators and employers alike, agreed that getting women into the metals trades was difficult. When the development of a slide-tape presentation featuring women in this occupational area was suggested as a means of reaching some students, it was

readily supported as a positive effort to make women more career aware. It was strongly suggested that this presentation should be made available as early as 7-9 grades.

The slide-tape content and development of the presentation was left to the Blackhawk Tech curriculum coordinator and AV Media Services Department to complete. As a result, the following decisions were made:

1. The audience would be 12-18 year-old girls.
2. Therefore, the slide-tape should, first of all, appeal to this age group.
3. An "old-time" movie theme and appropriate music was selected as having eye and ear appeal.
4. Information should be written in short phrases on key points with vocal support. Tables, grafts, and charts would be provided when necessary.
5. The content would include facts about monetary benefits, the training and educational background necessary, the place for women in the work force--especially in the metals area.
6. Total time of the slide-tape presentation would be 12-15 min.

Plans to distribute the presentation were also decided. The slide-tape would be sent to all 13 area high schools either through a local LVEC or to an administration in charge of vocational programs. An explanation of the project objectives and a script of the content would accompany the slide-tape. The Blackhawk Tech curriculum coordinator would manage the distribution of the certificates and slide-tapes.

APPENDIX A

WBVIAI Memorandum articulation Information; Doyle Beyl Director of Bureau of Research, August 21, 1980

Proposal and Project Letter

Approval letter: Doyle Beyl

September 23, 1980

State of Wisconsin
BOARD OF VOCATIONAL, TECHNICAL & ADULT EDUCATION

ROBERT P. SORENSEN, Ph.D
State Director
4802 Sheboygan Avenue, 7th Floor
MADISON, WISCONSIN 53702

August 21, 1980

MEMORANDUM

TO: District Directors
High School Relations Persons
Instructional Services Persons
Curriculum Specialists
Department Chairpersons

FROM: Doyle E. Beyl

SUBJECT: Articulation Secondary/Post-Secondary Vocational-Technical Education

Approximately 50,000 people enroll in vocational-technical post-secondary programs each year who have high school education. These people may have vocational education experiences from high school that vary from virtually none through the rather sophisticated "capstone" program. Articulation efforts will help to eliminate duplication of effort on the part of the student by identifying areas of competency where post-secondary training would be duplicative of secondary training. The post-secondary instructor may cease teaching the material which has been covered in the secondary school thereby allowing the instructor to extend learning experiences toward a more advanced level of competence. For these reasons we have again recommended funding an articulation activity on the State level. This activity may be carried out in each of the 16 VTAE Districts in cooperation with the secondary schools served by each respective district. Naturally, the funding is very limited. We cannot fund teacher salaries or consultant fees. We can fund "perdiem" costs or meal and mileage costs. We can also fund the cost of materials purchased, used and developed by participants. Final reports are vital for the dissemination, utilizatio and adoption of articulation procedures and products.

The respective districts may apply for this limited funding by indicating the occupation(s) they wish to articulate with secondary schools. Naturally, the secondary schools should be included in the planning of activities of this nature.

The activities should have measurable objectives. These objectives must include:

1. Upgrade staff capabilities to counter sex role stereotyping.

2. Identify competencies best taught at the secondary level and those best taught at the post secondary level. (The competencies may very well be those from the V-TECS catalog for the particular occupation being articulated.)

3. Develop competency based student achievement records that will accommodate advanced standing for students based on the secondary instructor's grading or rating of a student's competency achievements. (Another important use of a competency based student achievement record is during job application or job placement interviews with prospective employers.)

4. Develop a team approach to teaching educational mastery of competencies in an occupational area from secondary through post-secondary levels.

5. Develop an awareness, appreciation and faith of staff in the capabilities of their counterparts in either the VTAE or the secondary system.

The activity may be in the form of a letter indicating the occupational/curriculum, measurable objectives, methodology and a budget. Upon completion of the activity, five copies of a report indicating the curriculum work which has been accomplished must be submitted. Twenty five copies of products useable by other districts must be submitted for dissemination to them.

We would like very much to have the V-TECS catalogs utilized in this regard. We may have one staff member available for consultation to districts should they need orientation to the use of the catalogs. Your district's interest in this project and the probable occupational area or areas which will be articulated should be noted at an early date. We have limited funding available and this will be divided among those districts who wish to participate as equitably as possible. Should you, or the staff member who has questions regarding this activity wish, you may call me at (608) 266-1354.

DEB/emb

Blackhawk Technical Institute

CENTRAL FACILITY
Rt. 3, Prairie Road
Janesville, Wisconsin 53545
1 608 756 4121

O. L. Johnson
District Director

September 16, 1980

Mr. Doyle Boyl, Director
Bureau of Research, Professional
and Student Development
WBVTAE
4802 Sheboygan Avenue, Seventh Floor
Madison, WI 53702

Dear Doyle:

Please accept this proposal for an articulation project in the Machine Tool Trades area. Inquiries from secondary schools have indicated an interest through the DPI industrial education consultant, Dick Kitzmann, and the instructional staff at Blackhawk is eager to start.

The Machine Tool Program is a "staple" among our programs as it answers to the needs of local industry and student interest. An articulation activity would not only provide professional interchange between levels of this highly regarded skill training but also provide students with a smoother transition as they pursue their career goals.

May we have your support in this effort.

Sincerely,

O.L. Johnson
District Director

OJ:jr

Proposed
Articulation Activity for
Machine Tool Trades

Blackhawk Technical Institute
and Thirteen Area Secondary Schools

Blackhawk Technical Institute
Route 3, Prairie Road
Janesville, Wisconsin 53545
September, 1980

A. Proposal Data Sheet

Title:	Articulation Activity for Machine Tool Trades
Activity Delivery Agent:	Blackhawk Technical Institute Route 3, Prairie Road Janesville, Wisconsin 53545
Contact Person:	Esther Maier Curriculum Coordinator (608) 756-4121, Ext. 204
Amount Requested:	$2000.
Activity Year:	FY 80-81
Secondary Schools Included:	Janesville Parker Janesville Craig Beloit Memorial Monroe Orfordville Parkview Albany Beloit Turner Broadhead Clinton Edgerton Evansville Milton Monticello

B. Introduction:

Metal fabrication and especially the machine tool trades have historically been of great importance in the Blackhawk District. The schools' metal shops are busy places as they prepare students to enter a highly regarded and stable occupation. Both the secondary and post-secondary levels of training are involved, therefore indicating a transition of students as they progress up the career ladder. General metals instructors as well as machine tool and maintenance instructors have shown keen interest in developing communication lines that will benefit both levels in directing students toward their career goals.

C. Problem:

Not all schools have the facilities or capabilities of providing a total machine shop program. Others have sophisticated and well advanced training opportunities. One school may contract from another for services in this specific area. In order to establish a core curriculum and identify the "basics", an interchange of ideas, information, and materials should occur which will result in an established record of competencies that may provide a smoother and more efficient transfer of students from one level to another. This record may also, then, describe program content and student accomplishment to the metals industry and future employers.

D. Objectives:

1. Develop master list of machine shop/general metals competencies drawing from research and materials now in use from V-TECS in other state programs.

2. Determine standards for core competencies, whenever possible.

3. Establish a rating scale for evaluation of competencies.

4. Design a competency certificate to be used by the student as a communication link between training programs and with future employers.

5. Obtain advice and support from advisory committee members as representatives of industry and future employers as to the effectiveness of the certificate.

6. To develop and maintain professional contact between levels that will further enhance positive interchange of instructional staff.

7. To develop career awareness among women in the non-traditional area of the machine shop trades.

E. Methods and Procedures:

Three meetings will be developed to accomplish the objectives.

1. Meeting one will determine project goals, a time frame, and schedule. Resource and reference materials will be reviewed. Status of current programs will be discussed. A decision will be made as to the possible development and use of a ten minute slide-tape presentation geared for women's information on the machine shop occupations.

2. Meeting two will be a work session to establish "core" competencies and to determine scope and sequence of curriculum content that will incorporate both levels and all participating schools. Standards and a rating scale will be determined. The certificate format will be designed.

3. Meeting three will conclude the articulation activities with an informational meeting with advisory committee members to review the work completed, the certificate sample designed, and to describe the development plans and dissemination of the career awareness slide-tape presentation.

The Trade and Industry Division Chairman, the machine tool instructors, and curriculum coordinator will be actively involved in this effort. Thirteen area high schools will be invited to participate.

A sample certificate will be field tested before a final printing is done. The development of the slide-tape presentation will be monitored by the members- and later disseminated to each area high school participating.

F. Budget:

Dinners (3)		$800
Travel		$100
Printing		$400
AV Slide-Tape Presentations		$700
	Total	$2000

State of Wisconsin | BOARD OF VOCATIONAL, TECHNICAL & ADULT EDUCATION

ROBERT P. SORENSEN, Ph.D
State Director
4802 Sheboygan Avenue, 7th Floor
MADISON, WISCONSIN 53702

September 23, 1980

Mr. Orvis L. Johnson
District Director
Blackhawk VTAE District
Route 3, Prairie Road
Janesville, WI 53545

Dear Mr. Johnson:

Thank you for your proposal for your articulation project in the Machine Tool Trades area. I am sure this will result in an excellent articulation effort between Blackhawk and the Public Schools. I realize there is a great need for this sort of mechanic in the Blackhawk area. Hopefully, the material will utilize the V-TECS catalog "Machinist." If you or Ms. Maier have questions, please call.

Thanks again for your interest.

Sincerely,

Doyle E. Beyl

Doyle E. Beyl, Director
Bureau of Research, Professional
and Student Development

DEB/emb

cc Esther Maier
Curriculum Coordinator

APPENDIX B.

October 16, 1980, Workshop Letters, Agenda, and Minutes

Kearney and Trecker Corporation
Declaration of Industry Needs; 1980

Blackhawk Technical Institute

CENTRAL FACILITY
Rt. 3, Prairie Road
Janesville, Wisconsin 53545
1-608-756-4121

O. L. Johnson
District Director

September 24, 1980

Dr. Donald Mrdjenovich
Superintendent
Administrative Center
527 So. Franklin
Janesville, WI 53545

Dear Doctor Mrdjenovich:

Blackhawk Technical Institute would like to extend an invitation to your machine shop/metals instructors, Bill Jennings, and John Schwalbe, and your LVEC, Duane Buss to attend a series of three articulation meetings in the Machine Tool Trades area.

The project will be co-sponsored by DPI and WBVTAE and will attempt to identify the "core" competencies for the machine tool occupations. As a final product of these activities, a competency certificate will be developed to be used as a communication link between levels of training and future employers. The certificate will be a record of job skills accomplished by a student in both the secondary and post secondary programs.

The first meeting will be on October 16, 1980, beginning at 5 PM at the Plantation Motor Inn, 2956 Milwaukee Road, Beloit, Wisc. An evening meal will be provided. We would appreciate your support in this effort. Thank you.

Sincerely,

Dick Kitzmann

Dick Kitzmann
Consultant,
Industrial Education
Department of Public Instruction

Sincerely,

Frank Trafford

Frank Trafford
Trade and Industry
Division Chairman
Blackhawk Technical Institute

DK:jr
FT:jr

Blackhawk Technical Institute

CENTRAL FACILITY
Rt. 3, Prairie Road
Janesville, Wisconsin 53545
1-608-756-4121

O. L. Johnson
District Director

September 29, 1980

Jim Fremont
Beloit Turner High
1231 Inman Parkway
Beloit, WI 53511

Dear Mr. Fremont:

You are invited to attend a series of three articulation meetings beginning this fall in the area of Machine Tool Trades.

Specific objectives of this project are to develop a competency certificate that will list the core competencies needed for those in the metals occupations. This would be a communication link between levels of traing and serve as a job reco[illegible]for a future employer.

Join us on October 16, 1980, 5 PM [illegible]he Plantation Motor Inn, 2956 Milwaukee Road, Beloit, Wisconsin. [illegible]evening meal will be provided. A post card is enclosed for your response. Please return it to us no later than October 13. Thank you.

Sincerely,

Dick Kitzmann

Dick Kitzmann
Consultant
Industrial Education
Department of Public Instruction

Sincerely,

Frank Trafford

Frank Trafford
Trade and Industry
Division Chairman
Blackhawk Technical Institute

DK:FT:jr

AGENDA

MACHINE TOOL TRADES ARTICULATION

WORKSHOP

October 16, 1980
Plantation Motor Inn - Beloit

I. Dinner - "Welcome from Blackhawk"
O.L. Johnson, District Director

Introduction of Workshop Participants

II. Articulation - "What It Can Do For Our Programs"

Review of Recent Events
Esther Maier, Curriculum Coordinator, Blackhawk Tech

As Seen From DPI
Dick Kitzmann, Industrial Education Consultant

As Seen From VTAE and Blackhawk Tech
Bob Brown
Bill Peterson
Bob Housner
Instructional Staff, Blackhawk Tech

III. Goal Setting and Getting Organized
General Discussion

IV. Calendar of Coming Events

MINUTES

Articulation of Machine Tool Trades
Plantation Motor Inn

October 16, 1980

Members present:

John Schwalbe	Parker High School
Lloyd Edge	Clinton High School
Ray Romblom	Edgerton High School
Bill Jennings	Craig High School
Duane Buss	Janesville School District
LaVonne Keitch	Beloit Memorial High School
Jim Fremont	Beloit Turner High School
Donavan Jones	Clinton High School
Dave Ziegler	Monticello High School
Ken Sedbrook	Monroe High School
Bob Brown	Blackhawk Tech
Bill Peterson	Blackhawk Tech
Bob Housner	Blackhawk Tech
Frank Trafford	Blackhawk Tech
O. L. Johnson	Blackhawk Tech
Harold Thomas	Blackhawk Tech
Esther Maier	Blackhawk Tech
Dick Kitzmann	DPI

The meeting opened with an introduction of all participants and a general overview of events leading to the preparation of the workshop by Esther Maier. The basic proposal objectives were outlined and an explanation of a competency record certificate was given. If agreed to by the group, the certificate will be the end product of the articulation efforts.

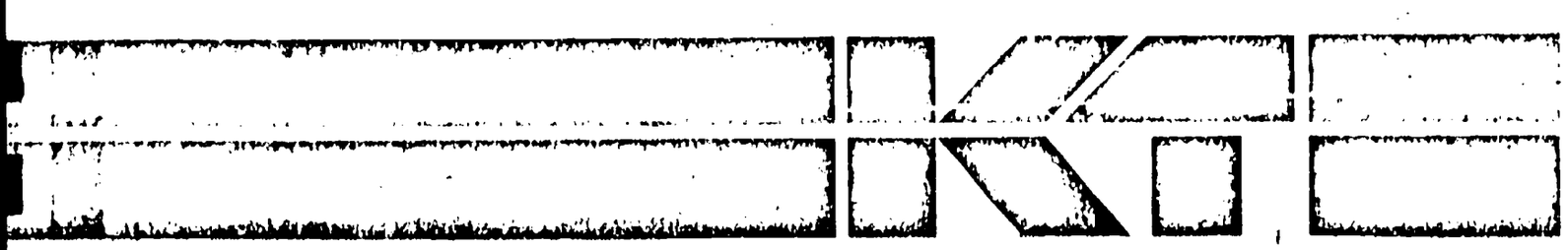
Dick Kitzmann explained DPI's position in the articulation activities and described the secondary level code numbers for program/course identification. He encouraged the group to develop a certificate that could be used both for future employers and for post-secondary training. Bob Brown, Bill Peterson and Bob Housner all commented on the worthiness of such a record and indicated it would be of great help to them in identifying students' past experiences and future needs. The discussion was then opened to all participants as to their reactions to the proposed activity.

The group agreed to continue the effort and a date of November 12, 1980, was set as to the next workshop. Time and place will be decided later. Esther Maier agreed to notify all members of the details. Materials presented by Blackhawk Tech were suggested as resources and references to be used in the next working session to identify competencies, the scope, and sequence of the general metals/machine tool curriculum. All instructors were encouraged to review the materials and to bring their course outlines and program curriculums for sharing and comparing. A rating scale and format for the certificate will be discussed and possibly determined at that time.

The meeting was adjourned.

DECLARATION of INDUSTRY NEEDS for GREATER MILWAUKEE PUBLIC & PRIVATE SCHOOL SYSTEMS

1980



Kearney & Trecker Corporation

FOREWORD

The objective of this document is to help industry and education achieve a mutually agreeable solution to the growing problem of preparing a declining population of interested high school students for rewarding careers in manufacturing plants. It has been prepared with the help of many hands throughout the community, and it will be used, we expect, by many more hands throughout the nation during the coming years. We encourage your comments, accolades and reprovals so that the future communications between educators, students, parents, and industry can be kept current, accurate and on-going.

George C. Marakas
President
Kearney & Trecker Corporation

The Kearney & Trecker Corporation has prepared this **DECLARATION of INDUSTRY NEEDS** for the public and private high school system serving the Greater Milwaukee Area through the cooperation and assistance of these companies:

- A. C. Spark Plug Division—General Motors Corporation
- Allen-Bradley Company
- Allis Chalmers Company
- American Motors Corporation
- A. O. Smith Corporation
- Briggs & Stratton Corporation
- Bucyrus-Erie Company Incorporated
- Cutler-Hammer/Eaton Corporation
- Evinrude Motors Division—Outboard Marine Corporation
- The Falk Corporation
- Harley-Davidson Motor Company Incorporated—Subsidiary AMF
- Harnischfeger Corporation
- The Heil Co.
- Johnson Controls Incorporated
- Koehring Company Incorporated
- Maynard Steel Casting Company Incorporated
- Mercury Marine—Division of Brunswick
- Oilgear Company
- Perfex Group—Division McQuay—Perfex Incorporated
- RTE Corporation
- Rexnord Incorporated
- Stolper Industries Incorporated
- Teledyne Wisconsin Motors
- Waukesha Engine—Division Dresser Industries Incorporated

This **DECLARATION of INDUSTRY NEEDS** outlines the basic educational requirements for students seeking careers in the machine trades of:

- Journeyman Tool and Die Maker
- Journeyman Machinist
- Production Machinist
- Tool Room Machinist
- Machinist—Setup
- Machine Operator
- Tool & Die Apprentice
- Machinist Apprentice
- Machine Operator Trainee
- Machine Loader/Helper

It should be understood that this particular DECLARATION of INDUSTRY NEEDS is related ONLY to the highly skilled industrial occupations listed above. It must also be recognized that utilization of these skills vary considerably between companies, from a majority of employees in some businesses to a relatively small percentage of the employees in others.

I. PREFACE

It is no exaggeration to say that the metalworking industry, through its widespread application of machine tools and associated technology, is largely responsible for the great material progress of the past 100 years. The metalworking industry penetrates every aspect of life—supplying in volume and quality, countless products essential to man's well being and security. Metalworking is at the heart of productivity—the key ingredient to continued economic growth and the standard of living we enjoy.

In view of this dominating role, it seems a paradox that the metalworking industry—which has created countless thousands of jobs outside its own parameters—should currently find itself unable to meet its own employment needs for properly educated people in the machine trades. The industry's primary resource—the high school graduate—once abundant and fruitful, has virtually disappeared. The acute shortfall of machine trades skills and talents is conclusively substantiated by the help-wanted ads in today's newspapers and trade publications.

The responsibility for this situation lies somewhere between ourselves as employers and the schools as educators. However, we assume the larger burden. While we have indulged in large-scale retraining and continuing education programs for our own employes, we have unintentionally neglected the high school systems under the mistaken assumption of their awareness of our personnel needs, changing job requirements and expanded career opportunities. In short, we failed to maintain communications—a laxity we propose to overcome by initiating herein a cooperative effort of mutual assistance encouraging a direct exchange of views and seeking comprehensive understanding of each other's needs and capabilities.

In substance, the following presentation represents "A DECLARATION of NEEDS" which sets forth the Greater Milwaukee Area metalworking industry's expectations of graduating high school students seeking machine trades careers. This Declaration makes clear our anticipated competencies of graduates in mathematics, mechanical drawing, measurement instrumentation, bench tools, metalcutting theory, metalcutting machines, safety regulations and procedures,oral and written shop term communications, and production standards. Additionally, this Declaration emphasizes development of positive student attitudes toward punctuality, attendance, productivity, continuing education, and participation in outside career-related activities.

In your appraisal of, and response to, this "DECLARATION of NEEDS," please be mindful that it is purposely broad and general, however comprehensive. There is no intention on our part to dictate an exact, inflexible, unadaptable course of instruction. Rather, we hope for its use as a basic guideline to achieve the optimum machine trades education possible, adapted to the variform capabilities of schools, staffs and facilities in the educational community. Our further objective is to encourage mutual participation in long-range planning and assistance in the development of all-embracing programs of education and training covering the full spectrum of industrial career opportunities.

David E. Horn
Manager Technical Training
Kearney & Trecker Corporation

II. MACHINE TRADES CAREERS —OPPORTUNITIES AND EXPECTATIONS

The Greater Milwaukee industrial area holds the distinction of worldwide recognition as a manufacturing center of high quality, precision-made products and components. The diversity and application of these products to society's needs are so manifold as to challenge enumeration. They answer a global demand in their direct use for the production of coal, electricity, oil, steel, farm crops, automobiles, trucks, aircraft, engines, medical apparatus, packaging and material handling equipment, water and pollution control systems, housing and construction materials– just to cite a few primary sectors of service to mankind provided by the Greater Milwaukee Area metalworking industry.

In all of these manufacturing enterprises, the use of machine tools (also a significant local product) and the employment of skilled machine tradesmen is pervasive, inseparable and vital. Unfortunately, today, this tandem relationship is sharply out of balance. The tradesmen are lacking in large numbers, despite the fact that opportunities for machine trade careers have never been so abundant and wide-ranging. They are present at all levels—from machine operator trainees to journeymen tool and die makers—offering personally rewarding jobs that satisfy, stimulate and compensate. They are jobs that lead directly into the closely related technologies of methods engineering, parts programming, computer application and systems analysis, to name only a few. They are jobs that open doors to supervision and management. They are jobs in which the learning process and challenge never ends. They are jobs in which ingenuity and ability are put to constant use. But job success and career progress hinge upon a solid foundation of basic knowledge acquired at the high school level.

Employers of career-minded machine trades graduates expect such persons to demonstrate a fundamental knowledge of metalworking embracing these seven technical requirements:

1) Basic familiarity with all metalworking arts;

2) Knowledge of metalcutting tools and usage;

3) Ability to select and use precision tools of the trade;

4) Ability to accurately read and interpret engineering drawings;

5) Ability to use mathematical principles in the solution of practical machining problems;

6) Basic understanding of how physical science principles apply to metalworking;

7) Full realization of what work standards are and the conditions affecting those standards.

The Greater Milwaukee Area metalworking industry strongly believes that most area high schools currently possess both the facilities and instructional expertise to effectively impart the foregoing essential knowledge. This capability needs only to be supported by a curriculum sequence that stresses the "career" rather than the "hobby" interest of the student. Industry stands ready to cooperate with and assist the educational community in achieving this direction of purpose and effort.

III. THE STARTING POINT —ANALYSIS AND APPRAISAL OF SCHOOLS, FACILITIES AND STAFF

The first step in proceeding toward the fulfillment of industry's "DECLARATION of NEEDS" for qualified job applicants in the machine trades requires an inventory of existing schools, facilities and staff—a self-appraisal, if you will, by school administrators, teachers and counselors to determine if, in fact, what industry is asking can be realistically accomplished.

To assist in obtaining this inventory and appraisal, an industry task force has developed a declarative survey form which each educator may use to express candid opinions and comments. This expert evaluation is needed to understand common problems and their resolutions through cooperation and assistance between educators and employers.

Industry's "DECLARATION of NEEDS" represents its side in this action program. The educator's side needs to be revealed as well. Participation in this survey offers that opportunity. We hope that everyone concerned will respond wholeheartedly.

Please direct all communications regarding this program to:

David E. Horn
Manager Technical Training
Kearney & Trecker Corporation
11000 Theodore Trecker Way
Milwaukee, WI 53214

PART ONE

INDUSTRY NEEDS AND EXPECTATIONS

Each question asked below focuses on particular metalworking industry needs and expectations from the educational system in the preparation of students for careers in the machine trades. Please respond whether or not you believe your school and your efforts are now or can be directed effectively toward a reasonable accomplishment of these needs and expectations. Your personal supplementary comment is solicited.

Important: Your "Yes—No" response to each of the questions or statements and your comments should be made on the "Declarative Survey Response Sheet" which is inserted in the back of this Declaration of Needs. Please read the instructions on the response sheet before proceeding.

A1. Does your current "Industrial Arts Program" emphasize career development as opposed to a hobby approach?

A2. If not, can the program be changed to accommodate career development?

A3. *Direct comments to response sheet.*

B1. Are teachers and counselors sufficiently familiar with the dignity, challenge, pay and employment benefits offered by careers in the machine trades field?

B2. *Direct comments to response sheet.*

C1. Can greater emphasis be attached to reading comprehension and mathematic skills, especially the latter, to achieve the higher level of competence required for machine trades entry?

C2. *Direct comments to response sheet.*

D1. Can individual courses of instruction be so tailored and taught to include written job instructions, and practical problem-solving work?

D2. Are teachers sufficiently knowledgeable to create and offer work assignments closely paralleling those encountered in real industrial situations?

D3. *Direct comments to response sheet.*

E1. Will teachers and counselors involved in this machine trades career program work closely with industry in reviewing and updating courses, keeping them current with industrial practice?

E2. *Direct comments to response sheet.*

F1. Can the school system (or school) undertake and implement an affirmative action program encouraging junior high level females and minorities to consider machine trades careers, and embark on an educational program which will prepare them for industrial employment upon graduation?

F2. *Direct comments to response sheet.*

G1. Will teachers and counselors in the machine trades be willing to participate with area industry in the development of informational materials (e.g., literature, films) designed to attract young people to this career program?

G2. *Direct comments to response sheet.*

H1. Will the Greater Milwaukee Area school systems, in cooperation with the area industry, undertake the planning steps necessary to establish a K-12 career education program, and to test various pilot efforts in that direction?

H2. *Direct comments to response sheet.*

PART TWO

REQUIRED COMPETENCIES OF GRADUATES MAJORING IN MACHINE TRADES

NOTE: For all the following sections, a "YES" response indicates you feel your school can or is accomplishing the competency; a "NO" indicates you feel your school is not or cannot. Please comment on all "NO" responses.

MATHEMATICS SECTION

A. Graduate must have completed four (4) semesters of high school mathematics.

B. Graduate should be able to analyze and solve a variety of practical machine trade problems that apply the fundamentals of arithmetic, algebra and geometry, such as:

1. Add, subtract, multiply and divide whole numbers
2. Add, subtract, multiply and divide fractions.
3. Convert fractions to decimal equivalents.
4. Calculate percentages.
5. Work with ratios.
6. Work with simple formulas and basic algebraic equations.
7. Work with basic plane geometry concepts.
8. Solve basic right angle trigonometry problems using handbook formulas.
9. Work with English and metric weights and measures.
10. Convert English lineal measurements to metric and vice versa.
11. Calculate cutting speeds and feeds.
12. Calculate depth of cut.
13. Calculate amount of time required for cut.
14. Solve typical taper problems.
15. Calculate angular relationships.
16. Solve sine bar problems.
17. Solve problems involving precision location of holes.
18. Exhibit ability to use basic reference tables and charts such as the "Machinist's Handbook".

C. *Direct comments to response sheet.*

MECHANICAL DRAWING/PRINT READING SECTION

A. Graduate must have completed two (2) semesters of mechanical drawing and two (2) semesters of print interpretation.

B. Graduate should be able to comprehend and skillfully interpret typical industrial engineering drawings, demonstrating the ability to:

1. Distinguish between first and third angle projection.
2. Differentiate between orthographic and pictoral drawings.
3. Demonstrate skill in sketching simple orthographic and pictoral drawings.
4. List the requirements of a working drawing.
5. Differentiate between decimal inch, fractional, and metric dimensioning techniques.
6. Differentiate between object lines and hidden lines.
7. Demonstrate skill in the projection of sloping surfaces.
8. Describe the method of dimensioning angles.
9. Describe the meaning of degrees, minutes, and seconds as they apply to angular measurement.
10. Differentiate between the symbols used to describe angular requirements.
11. Differentiate between scaled up and scaled down drawings
12. Differentiate between rounds and fillets.
13. Describe the method of dimensioning circular features.
14. Identify a centerline and list its uses.
15. Identify and differentiate between countersink, counterbore and spot facing.
16. Describe the process of drilling, reaming, boring, counterboring, countersinking and spot facing.
17. List the uses for break lines.
18. Differentiate between long and short break lines.
19. Define surface finish characteristics: waviness, roughness, waviness height, roughness height.
20. List possible causes of surface imperfections.
21. Recognize the old and the new finish marks and interpret their meaning.
22. Differentiate, in section views, between cutting plane lines and section lines.
23. Differentiate between materials based on the types of section lining used.
24. Interpret one-view drawings.
25. Interpret two-view drawings.
26. Differentiate between the terms "tolerance" and "allowance".
27. Interpret and differentiate between bilateral, unilateral, and limit tolerancing techniques.
28. Interpret general tolerance notes.
29. Fully describe inch and metric screw threads based on common symbology.
30. Identify the parts of a screw thread:
    a) major, minor, and pitch diameters
    b) crest
    c) root
    d) thread depth
    e) thread and helix angles
    f) pitch and lead
31. Differentiate between single, double, and triple cut threads.

MECHANICAL DRAWING/PRINT READING SECTION (continued)

32. Identify and differentiate between revolved and removed sections.

33. Differentiate between a keyway and a keyseat.

34. Identify and describe various kinds of keys.

35. Describe the general dimensioning techniques for keyways, keyseats, and keys.

36. Identify and differentiate between a boss and a pad.

37. List common uses of pads and bosses.

38. Interpret drawing revisions.

39. Identify and interpret arrowless and tabular dimensioning techniques.

40. List advantages of these techniques over in-line dimensioning technique.

41. Interpret drawings using arrowless dimensioning as well as tabular dimensioning.

42. Specify for finished holes—drilling, reaming, boring, and spot facing.

43. Determine the method of machining based on the purpose.

44. Understand the trade theory for molding, coring, and casting.

45. Understand the purpose of dovetail slots and sides.

46. Understand the method of dimensioning dovetails and the method of inspection or checking.

47. Fully understand the necessity of visualizing through all the views given.

48. Consider factors in the selection and naming of views.

49. Consider the S.A.E. numbering system for steels.

50. Consider the use of partial views.

51. Distinguish between the various kinds of pipe threads (NPS, NPT, etc.).

52. Define the symbols used in pipe thread nomenclature.

53. List various standards organizations.

54. Define the term standards.

55. List the kinds of standards found in the industrial environment.

56. Use the metric system of linear measure.

57. List the advantages and disadvantages of the metric system over the inch system.

58. Convert inches to millimeters.

59. List the reasons for partial views.

60. Interpret engineering drawings.

61. Identify different structural shapes.

62. Recognize a structural shape from standard nomenclature.

63. Identify a phantom line.

64. List the reasons for use of the phantom outline.

65. Interpret a drawing containing phantom outlines.

66. Define an auxiliary view.

67. Explain the need for machining lugs, and identify a machining lug on an engineering drawing.

68. Explain the difference between "coordinate" and "true position" tolerancing.

69. Recognize and interpret positional and form symbols.

MECHANICAL DRAWING/PRINT READING SECTION (continued)

70. Interpret form tolerances.

71. Understand the meaning of and reason for geometric tolerance symbols.

72. Interpret an engineering drawing using standard symbology to define positional and form tolerances.

C. *Direct comments to response sheet.*

MEASURING EQUIPMENT SECTION

Graduate must be able to identify and skillfully use the following measuring equipment, and to inspect results associated with their use:

A. Instruments:

1. Micrometers (outside, inside and depth)
2. Verniers (calipers, height and depth)
3. Rules (fractional, decimal, metric)
4. Dial Indicators (mechanical and electronic)
5. Combination Square Set
6. Protractor

B. Gages:

1. Snap
2. Plug
3. Ring
4. Pin
5. Thread
6. Surface
7. Depth
8. Length
9. Telescope
10. Screw Pitch
11. Light
12. Dial bore
13. Contour
14. Radius
15. Small Hole
16. Sine Bar
17. Three Wire Measurement of Screw Threads
18. Comparison Blocks
19. Thickness
20. Adjustable Parallels
21. Planer Gage

C. Inspection Table Tools:

1. Tables (steel, granite)
2. Parallels (box, solid, granite)
3. Angle Plates (toolmaker's knee)
4. V-Blocks
5. Squares (steel, bevel edge, cylindrical and granite)
6. Bench Centers
7. Indexing Head

D. Inspection Determinations for:

1. Out of round
2. Taper
3. Bellmouth
4. Barrel or Hour Glass
5. Slot Symmetry
6. Squareness
7. Straightness
8. Flatness
9. Parallelism
10. Perpendicularity
11. Alignment
12. Concentricity
13. Finish
14. Size
15. Tolerance

E. *Direct comments to response sheet.*

HAND TOOL AND BENCH WORK SECTION

Graduate must be able to identify and skillfully use the following hand and bench tools:

A. Hammers (hard and soft)

B. Screwdrivers

C. Bench Vise

D. Files

E. Chisels and Punches

F. Wrenches (open end, box, adjustable, socket, hex key and spanner)

G. Hand Taps and Tapping

H. Threading Dies

I. Hand Hack Saws

J. Layout Tools

1. Coating Materials
2. Scriber & Dividers
3. Prick Punch
4. Vernier, dial or digital height gage (with scriber)
5. Center Punch
6. Vee-Blocks
7. Steel Beam Trammels
8. Combination Square Set
9. Hermaphrodite Caliper
10. Angle Plates
11. Surface Gage

K. *Direct comments to response sheet.*

METALCUTTING CONDITIONS SECTION

Graduate must be able to demonstrate an understanding of the following metalcutting conditions:

A. Proportion of Stock Removal—Rough to Finish Cuts

B. Cutting Speed Determination and Tool Life

C. Relation of Spindle Speed to Feed

D. Tool Feeds

E. Threading Feeds

F. Production Rate Determination

G. Power Requirement

H. Tool Forces

I. Cutting Tool Materials

J. Stock Machining Allowances

K. Machinability of Steels

L. *Direct comments to response sheet.*

METALCUTTING MACHINES SECTION

Graduate must be able to demonstrate proficiency in the basic set-up and operations of drilling machines, turning machines, milling machines, and grinding machines. The specific competency requirements for each of these basic machine tool classifications are listed below:

A. Drilling Machines

1. Working knowledge of drills, reamers and taps, including selection and mounting, tool life, speeds and feeds.

2. Ability to recognize causes of and effect remedies for tool breakage, chatter, poor finish, short tool life and oversize holes.

3. Ability to operate machine by hand or power.

4. Knowledge of machine's principal components (column, table, spindle), proper care, lubrication and maintenance.

5. Knowledge of proper set-up procedures:

   a) Clean and prepare table, free from chips, knicks and burrs.

   b) Ability to locate and hold jigs and fixtures.

   c) Understand use of rotary tilting index table.

6. Ability to perform the following operations:

   a) Drilling

   b) Reaming

   c) Tapping

   d) Spot Facing

   e) Counterboring

   f) Countersinking

   g) Center Drilling

   h) Back Facing

7. *Direct comments to response sheet.*

B. Turning Machines

1. Knowledge of basic types and movements:

   a) Engine lathes (standard, heavy duty, bench and precision)

   b) Turret lathes (horizontal, vertical)

   c) Automatic lathes, (chucking, collet or bar, center to center)

   d) Spindle rotation, cutter advance, longitudinal and across feed movements.

2. Knowledge of facing operations on:

   a) Ends of short pieces in collet or chuck.

   b) Ends of long pieces faced on centers.

   c) Ends of long pieces faced on steady-rest.

   d) Shoulders and flanges.

3. Knowledge of centering operations on:

   a) Shafts by hand layout, on or off the lathe.

   b) Short pieces or pieces which extend into the spindle.

   c) Long pieces too long to pass through spindle (on steadyrest).

   d) In-line centering of opposite ends.

   e) Use of centers for turning.

   f) Use of centers as a guide for drilling.

   g) Use of off-line centers with parallel axes for eccentric turning.

4. Knowledge of holding centered parts for subsequent operations:

   a) Use of faceplate, dog and live center headstock, and dead or live center in tailstock. (Such use must include: how to check and true spindle; live center in position and regrind in position if necessary; to align

tail stock center for straight cylindrical cuts; to swing tailstock to one side for taper cuts; to lubricate dead center; to check for excessive pressure on tailstock as workpiece warms up.)

b) Use of collet or chuck to hold one end and tailstock center to the other end of workpiece.

c) Use of mandrel, stationery steady-rest and follow rest.

5. Knowledge of chucking (internal or external gripping):

a) How to check for and obtain concentricity with spindle axis or diameter of part by these methods: indicator, chalk, wiggler, surface gage.

b) Use of 3-jaw chuck (reversible top jaws): truing through use of shims; gripping to avoid springing or excess pressure on thinwalled workpiece; using special jaws in handling odd-shaped pieces; boring soft jaws.

c) Use of a 4-jaw chuck with independent, reversible jaws: how to adjust to center workpiece accurately; to locate for eccentric diameters; to hold unusual shapes; advantages over 3-jaw chuck.

d) Use of collets (push or draw types): advantages in gripping long bar stock accurately and without damage; how to support long end to prevent whipping motion.

e) Use of face plate: how to mount fixtures to hold both commonly or unusually shaped parts; use of drive plates for lathe dogs.

6. Knowledge of outside diameter turning:

a) Avoiding springing on general cylindrical work, and correcting for unwanted taper on long work.

b) Use of taper attachment for taper turning; offset tailstock to suit taper; use of compound.

c) Eccentric diameters.

d) Stock allowances for grinding or other finishing operations.

7. Knowledge of radius turning or other curved forms:

a) Use of single point tools and template for checking.

b) Use of form tools.

c) Obtaining a simple radius.

d) Forming a ball at end of shaft with single point or form tool.

8. Knowledge of cut-off operation:

a) Why and how side clearance is ground on cutter.

b) Support requirements for thin and long cutter blades.

c) Maximum distance from collet in relation to bar diameter.

9. Knowledge of external threading operations (U.S. Standard, S.A.E.—N.C. or N.F., Acme, square thread, and metric thread forms):

a) Use of collapsible die head.

b) Use of hand die and stock, using tailstock as a pusher.

c) Single point chasing: ability to sharpen and set cutter to a center gage for angle and height; to advance tool to proper depth using thread form mathematics; to set gear box for proper lead; to properly engage the half-nut mechanism; to set a compound angle; to properly effect compound advance and cross slide advance movements; and how to single point double and triple threads.

METALCUTTING MACHINES SECTION (continued)

10. Knowledge of internal threading operations:
    a) Use of collapsible and solid taps. and internal thread chasing.
11. Knowledge of drilling operations:
    a) How to hold by Jacobs chuck or taper shank sleeves.
    b) Properly ground drills for material to be machined, and importance of equal cutting edge length.
    c) Lubrication of drill, and drill withdrawal for chip removal.
12. Knowledge of boring operations:
    a) Assuring proper rigidity of boring bar.
    b) Use of steadyrest to avoid unwanted taper.
13. Knowledge of counterboring operations:
    a) With a boring tool following a drill.
    b) With a flat-bottom drill following a drill.
    c) With a piloted counterboring tool.
14. Knowledge of reaming operations:
    a) Purpose and necessity of reaming.
    b) Various types of reamers: solid, expansion, hand, machine, rose, shell, floating.
    c) Speed of work, withdrawing a reamer, amount of stock to be left for different diameters.
15. Knowledge of knurling operations:
    a) Purpose, how work is held, lubrication and feed.
    b) How knurling tool is fed into the work on short and on long knurls.
16. Mandrel knowledge:
    a) Various types: taper, straight, with nut and washer, expanding, cone.
    b) Holding mandrels: between centers; between chuck and center; in chuck only.
17. Knowledge of lathe accuracy, inspection and adjustment:
    a) Familiarity with American standards for boring, turning and facing.
    b) Proper use of machine lubricants.
    c) Protection of bed ways and sliding units and maintaining correct alignments through regular adjustment.
    d) Care and proper use of dials and micrometer stops.
18. Knowledge of cutting tools:
    a) Materials: high speed steel, stellite, carbide, ceramic—advantages of each and when to use.
    b) Shapes for roughing, finishing; left and right hand; threading; grooving; forming; parting, etc.
    c) Angles of rake, clearance, drag, relief and type of grind best suited for workpiece materials.
    d) Types: forged, brazed or bit insert.
    e) Angles of application: center height or tangent.
19. Knowledge of speeds and feeds:
    a) Selection of speeds based on workpiece material, size and shape, lot size of work; and cutters available for the job.
    b) Selection of feeds based on workpiece material, cut requirements and lot size. Use of lever shift or pick-off gears to make selection.
20. *Direct comments to response sheet.*

C. Milling Machines

1. Knowledge of basic types and styles:
   a) Knee types (plain, universal, vertical)
   b) Bed types (horizontal, vertical, bridge)
   c) Special types (rotary head, contour, profiling, future trends, etc.)
2. Knowledge of milling machine attachments and how to mount and use, either singly or in combinations:
   a) 3-jaw universal chuck and chuck adapter.
   b) Dividing heads & rotary tables.
   c) Standard, plain, and swivel vises.
   d) Vertical milling attachments.
3. Knowledge of cutters and application:
   a) Materials, sharpening, and wear life.
   b) Proper selection and mounting.
   c) Proper feed and speed selection, based on workpiece material, cut requirements, finish, etc.
   d) Recognizing the causes and correction of: non-flat surfaces, cutter breakage, chatter, poor finish, overheating of arbor support, machine stalling during cut, short tool life per grind.
4. Knowledge of milling operations:
   a) Conventional and climb.
   b) Keyway, keyseat, T-slot, face, and end milling.
5. Knowledge of set-up procedures:
   a) Keeping table clean, free of nicks and burrs.
   b) Select proper bolts, nuts, washers, clamps, stops, and how to position.
   c) Know how to handle workpiece or fixture for locating and positioning on table.
   d) Know how to select proper T-slots for bolt and fixture location.
6. Knowledge of machine operation, inspection, lubrication, and adjustment:
   a) Ability to operate machine and control all movements by hand or power.
   b) Ability to determine proper depth of cut for roughing and finishing operations.
   c) Know how to accurately control backlash.
   d) Protecting ways of sliding members and maintaining correct alignments through regular adjustment of gibs.
   e) Ability to set and use dials, micrometer stops, trip dogs, etc.
   f) Lubrication of all ways, table and arbor supports.
7. *Direct comments to response sheet.*

D. N/C Machining Centers

Graduate must be able to demonstrate an understanding of the following principles: *(NOTE: It is felt that these basic N/C principles can be learned in the classroom, and actual hands-on experience is not required).*

1. The basic concept on which N/C is founded as well as its practical application.
2. The components of an N/C system and their interrelated functions.
3. The specific benefits of N/C in the production process.
4. The Cartesian Coordinate System.
5. Absolute and incremental positioning.

METALCUTTING MACHINES SECTION (continued)

6. The concept of interpolation as it applies to machining.
7. The four primary methods of program input.
8. The BCD (Binary Coded Decimal) coding system.
9. The differences in hardwired and soft-wired control units.
10. The basic steps in developing a part program.
11. *Direct comments to response sheet.*

E. Grinding Machines

1. Knowledge of basic types:
   a) Surface, external (cylindrical) internal, centerline, pedestal.
2. Knowledge of grinding wheels:
   a) Construction, abrasive materials, bonding materials, grain size, grade and structure, markings.
   b) Inspection.
3. Knowledge of basic surface grinding operations:
   a) Maintaining size, parallelism, squareness (each within .0002").
   b) Maintain a 32 microinch finish.
4. *Direct comments to response sheet.*

SAFETY AND HEALTH REGULATIONS

A. Knowledge of machining hazards, protective safeguards and equipment, and safe practices.

B. Knowledge of and compliance with health and safety regulations.

C. *Direct comments to response sheet.*

JOB COMMUNICATIONS PROFICIENCY

A. Ability to communicate orally and in writing, using proper shop terminology.

B. Ability to comprehend written or machine punched job instruction information and directions.

C. Ability to understand basic computerized runoff sheets related to attendance, productivity, job instruction, and payroll items.

D. *Direct comments to response sheet.*

POSITIVE JOB ATTITUDE FORMATION

A. Exhibit ingenuity and resourcefulness in setting up for production and working to rates.

B. Perform productively without sacrificing quality of output.

C. Develop clear-cut industrious approach to punctuality, attendance, use of work time, and cooperation.

D. Pursue continuing education and/or training to expand skills and capabilities which prepare for higher level job opportunities in the machine trades.

E. Join the Vocational Industrial Clubs of America and participate in its activities.

F. Develop an understanding of how the students' performance affects other employees and their jobs.

G. Be knowledgeable in how to fill out an application form and how to participate in an employment interview.

H. Develop a respect for authority and ability to listen and follow directions.

I. *Direct comments to response sheet.*

YOUR TITLE _____

MECHANICAL DRAWING/PRINT READING SECTION	MEASURING EQUIPMENT SECTION	HAND & BENCH TOOL SECTION	METAL CUTTING MACHINES SECTION
A1 A2 B1 C1 D1 D2 E1 F1 G1 H1	A1 A2 A3 B1 B2 B3 C1 D1 E1 F1 G1 H1	A B C D E F G H I J K	A1 A2 A3 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20 B37 B55 C1 C2 C3 C4 C5 C6 D1 E1 E2 E3

COMMENTS:

INDUSTRY NEEDS & EXPECTATIONS: _____

MATHEMATICS _____

MECHANICAL DRAWING/PRINT READING: _____

MEASURING EQUIPMENT SECTION: _____

HAND & BENCH TOOL SECTION _____

METAL CONDITIONS SECTION _____

METAL CUTTING MACHINES SECTION _____

METAL CUTTING MACHINES SECTION *(continued)* _____

HEALTH & SAFETY REGULATIONS _____

JOB COMMUNICATIONS EFFICIENCY _____

POSITIVE JOB ATTITUDE FORMATION _____

APPENDIX D

December 2, 1980, Workshop
Letters, Agenda, Minutes

Informational Letter;
Lloyd Edge, LVEC, Clinton
High School, December 3, 1980

Blackhawk Technical Institute

CENTRAL FACILITY
Rt. 3, Prairie Road
Janesville, Wisconsin 53545
1-608-756-4121

C. L. Johnson
District Director

October 27, 1980

Del Wagner
Albany High School
Box 349
Albany, WI 53502

Dear Mr. Wagner:

Please mark your calendar for the second articulation meeting in Machine Tool Trades on November 12, 1980 at 5 PM. We will meet at Blackhawk Tech, Beloit Campus, 1149 Fourth Street, Beloit. Dinner will be provided by the Food Service Students. We will use this meeting as a working session to establish the competencies, rating scale, and format of a competency certificate as agreed upon during the first meeting. So please bring any course outlines or materials you feel should be included as resources.

I apologize for the noise and the inconvenience it caused at our last meeting. It was with this in mind that we decided to hold the second session at the Beloit Campus where we can have access to much quieter facilities.

Thank you for the support you have shown for this project. We hope it will be beneficial for all members involved. Please return the enclosed post card by November 7, 1980, so that the Food Service people may make their plans accordingly.

Sincerely,

Esther Maier

Esther Maier
Curriculum Coordinator
Blackhawk Tech

EM:jr

AGENDA

MACHINE TOOL TRADES ARTICULATION
WORKSHOP

November 12, 1980
Blackhawk Technical Institute - Beloit Campus

I. Setting the Core Curriculum

II. Identifying Core Competencies

III. Scope and Sequence of the Core Competencies

IV. Determining Levels of Training

V. Establishing Machine Tool Trades
Standards / Rating Scale

VI. Selecting a Competency Certificate Format

VII. Calendar of Coming Events

MINUTES

Articulation of Machine Tool Trades
Blackhawk Technical Institute - Beloit Campus

November 12, 1980

Members Present:

John Schwalbe	Parker High School
Lloyd Edge	Clinton High School
Donovan Jones	Clinton High School
Tom Skorpinski	Turner High School
Frank Trafford	Blackhawk Technical Institute
Bob Brown	Blackhawk Technical Institute
Bill Peterson	Blackhawk Technical Institute
Bob Housner	Blackhawk Technical Institute
Harold Thomas	Blackhawk Technical Institute
Esther Maier	Blackhawk Technical Institute

The meeting began with a short discussion as to how to manage the information needed for the record and a decision was made as to procedures the group would use to determine the competency list.

It was decided to review all major categories as listed on the Machine Tool Competency Record currently being used by Blackhawk as to the relativity of the categories to all training programs represented and to delete or add any major areas as seen as needed. Following this step, the group would then look at specific items under each category as to need, wording, correct placement, and generally for inclusiveness of the competencies for participating programs.

At this point, the rating scale was reviewed, and it was agreed to use a three point scale: 0 - not taught or no opportunity to observe; 1 - can perform some parts of the skill satisfactorily, but requires instruction and supervision to perform the entire skill; 2 - can perform this skill satisfactorily without assistance and/or supervision.

Approximately one-half of the present record was carefully scrutinized and rewritten. Under each major category, it was decided to list specific safety items and to also include an area for additions. The term OTHER would be added to each section and space provided for three items. This would provide for flexibility and individualization of each program.

The group then decided to continue the process at a later meeting. December 2, 1980, was selected as a date, and the Beloit Campus facilities were suggested as a meeting place. Esther Maier agreed to check this out and notify everyone of the details. It was also decided to have a rough draft copy of the completed revision sent to all members for review and in preparation for the next session.

The meeting was adjourned.

MACHINE TOOL

TASK: #D-1

TASK: Take outside micrometer readings.

CRITERIA STATEMENT:

Student competence in taking outside micrometer readings will be recognized when the student successfully completes the following:

1. Names the five (5) basic parts of an outside micrometer.
2. Checks micrometer for accuracy.
3. Holds workpiece in one hand and micrometer in the other hand and obtains proper "feel".
4. Reads and records measurement.

DIRECTIONS TO THE STUDENT:

Provided access to a micrometer and several test pieces (both round and square stock), the student will measure each piece and record the results following the steps listed below:

1. Name the five (5) basic parts of an outside micrometer.
2. Check micrometer for accuracy.
3. Holding workpiece in one hand and micrometer in the other hand, obtain proper "feel".
4. Read and record measurement.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:	Yes	No
1. Name the five (5) basic parts of an outside micrometer?		
2. Check micrometer for accuracy?		
3. Hold workpiece in one hand and micrometer in the other hand and obtain proper "feel"?		
4. Read and record measurement?		

Did the student:

	Yes	No
5. Obtain the correct readings?		
6. Record an accurate reading to plus or minus .001" or if using vernier micrometer, plus or minus .0002"?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

MACHINE TOOL

TASK: #D-2

TASK: Determine flatness with dial test indicator.

CRITERIA STATEMENT:

Student competence in determining flatness with a dial test indicator will be recognized when the student successfully completes the following:

1. Cleans surface plate.
2. Mounts dial indicator to holding device.
3. Cleans workpiece and removes burrs.,
4. Moves dial indicator across workpiece, checking all four corners.
5. Determines and records flatness.

DIRECTIONS TO THE STUDENT:

Provided access to dial indicator, surface plate, and a workpiece, the student will determine the flatness of a workpiece with a dial test indicator and record the results on a worksheet following the steps listed below:

1. Clean surface plate.
2. Mount dial indicator to holding device.
3. Clean workpiece and remove burr.
4. Move dial indicator across workpiece, checking all four corners.
5. Determine and record flatness.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator and submit the completed worksheet.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:

	Yes	No
1. Clean surface plate?		
2. Mount dial indicator to holding device?		
3. Clean workpiece and remove burrs?		
4. Move dial indicator across workpiece, checking all four corners?		

#D-2

Did the student:

	Yes	No
5. Determine flatness and reocrd results on worksheet?		
6. Determine flatness of the workpiece within ± .0005 tolerance?		
7. Correctly use proper tools for the task?		
8. Demonstrate proper safety precautions?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

TASK: Determine accuracy of precision measurement instruments.

CRITERIA STATEMENT:

Student competence in determining accuracy of precision measurement instruments will be recognized when the student successfully completes the following:

1. Obtains gage of known size.
2. Measures gage with precision measuring instrument.
3. Determines accuracy of precision measurement instrument.
4. Adjusts, if necessary.

DIRECTIONS TO THE STUDENT:

Provided access to gage, instrument, and surface plate, the student will determine accuracy of precision measurement instruments with gage following the steps listed below:

1. Obtain gage of known size.
2. Measure gage with precision measuring instrument.
3. Determine accuracy of precision measurement instrument.
4. Adjust, if necessary.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:

	Yes	No
1. Measure the gage with the precision measuring instrument?		
2. Determine accuracy of the precision measuring instrument?		
3. Adjust instrument to specifications?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

TASK: Measure and perform layout work with height gage.

CRITERIA STATEMENT:

Student competence in measuring and performing layout work with height gage will be recognized when the student successfully completes the following:

1. Checks all dimensions from blueprints.
2. Sets up equipment on surface plate.
3. Cleans and removes burrs from stock.
4. Coats workpiece with layout fluid.
5. Mounts workpiece with suitable holding device.
6. Scribes reference on base line.
7. Sets height gage to specified heights and scribes all lines.
8. Checks blueprint for accuracy.
9. Rescribes lines, if necessary.

DIRECTIONS TO THE STUDENT:

Provided access to blueprint, workpiece, cleaner, files, layout fluid, mounting devices, layout tools, height gage, and suitable surface plate, the student will measure and perform layout work with height gage following the steps listed below:

1. Check all dimensions from blueprints.
2. Set up equipment on surface plate.
3. Clean and remove burrs from stock.
4. Coat workpiece with layout fluid.
5. Mount workpiece with suitable holding device.
6. Scribe reference on base line.
7. Set height gage to specified heights and scribe all lines.
8. Check blueprint for accuracy.
9. Rescribe lines, if necessary.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:

	Yes	No
1. Check all dimensions from blueprints?		

Did the student:	Yes	No
2. Set up equipment on surface plate?		
3. Clean and remove burrs from stock?		
4. Coat workpiece with layout fluid?		
5. Mount workpiece with suitable holding device?		
6. Scribe reference on base line?		
7. Set height gage to specified heights and scribe all lines?		
8. Check blueprint for accuracy?		
9. Rescribe lines, if necessary?		
10. Complete layout within an accuracy of ± .001" and angle to an accuracy of 5 minutes?		
11. Correctly use proper tools for task?		
12. Demonstrate proper safety precautions?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

MACHINE TOOL

TASK: #D-5

TASK: Measure with sine bar.

CRITERIA STATEMENT:

Student competence in measuring with a sine bar will be recognized when the student successfully completes the following:

1. Determines angle required from blueprint.
2. Cleans surface plate, gage blocks, and sine bar.
3. Selects constant (for degrees and minutes) from handbook or other tables.
4. Selects and wrings gage blocks to correct height.
5. Places sine bar on surface plate and gage blocks.
6. Places workpiece upon sine bar and determines workpiece angle with dial indicator mounted on surface gage.

DIRECTIONS TO THE STUDENT:

Provided access to workpiece, file, cleaner, suitable surface plate, gage blocks, sine bar, Machinery Handbook, and any other necessary tools and equipment for measuring angle, the student will measure with sine bar following the steps listed below:

1. Determine angle required from blueprint.
2. Clean surface plate, gage blocks, and sine bar.
3. Select constant (for degrees and minutes) from handbook or other tables.
4. Select and wring gage blocks to correct height.
5. Place sine bar on surface plate and gage blocks.
6. Place workpiece upon sine bar and determine workpiece angle with dial indicator mounted on surface gage.

STUDENT RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:

	Yes	No
1. Determine angle required from blueprint?		
2. Clean surface plate, gage blocks, and sine bar?		

Did the student:

	Yes	No
3. Select constant (for degrees and minutes) from handbook or other tables?		
4. Select and wring gage blocks to correct height?		
5. Place sine bar on surface plate and gage blocks?		
6. Place workpiece upon sine bar and determine workpiece angle with dial indicator mounted on surface gage?		
7. Measure angle to within 5 minutes?		
8. Correctly use proper tools for the task?		
9. Demonstrate proper safety precautions?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

TASK: Wring gage blocks to specific dimensions.

CRITERIA STATEMENT:

Student competence in wringing gage blocks to specific dimensions will be recognized when the student successfully completes the following:

1. Determines dimension required.
2. Selects gage blocks that equal height required.
3. Cleans and inspects for any flaws on gage block surfaces.
4. Places gage blocks in contact and wrings any air out from between them.
5. Adds gage blocks until dimension is reached.

DIRECTIONS TO THE STUDENT:

Provided access to precision gage blocks and specific dimensions, the student will wring gage blocks to specific dimensions following the steps listed below:

1. Determine dimension required.
2. Select gage blocks that equal height required.
3. Clean and inspect for any flaws on gage block surfaces.
4. Place gage blocks in contact and wring any air out from between them.
5. Add gage blocks until dimension is reached.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:	Yes	No
1. Determine dimension required?		
2. Select gage blocks that equaled height required?		
3. Clean and inspect for any flaws on gage block surfaces?		

Did the student:

	Yes	No
4. Place gage blocks in contact and wring any air from between them?		
5. Add gage blocks until dimension was reached?		
6. Obtain a dimension to the millionth?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

MACHINE TOOL

TASK: #D-7

TASK: Take inside micrometer readings.

CRITERIA STATEMENT:

Student competence in taking inside micrometer readings will be recognized when the student successfully completes the following:

1. Names basic parts of micrometer.
2. Checks micrometer for accuracy.
3. Reads and records measurements.

DIRECTIONS TO THE STUDENT:

Provided access to a micrometer and several test pieces, the student will measure each piece and record the results following the steps listed below:

1. Name basic parts of micrometer.
2. Check micrometer for accuracy.
3. Read and record measurements.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:

	Yes	No
1. Name the basic parts of the micrometer?		
2. Check micrometer for accuracy?		
3. Read and record measurements?		
4. Obtain correct readings?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

MACHINE TOOL TASK: #D-8

TASK: Take depth micrometer readings.

CRITERIA STATEMENT:

Student competence in taking depth micrometer readings will be recognized when the student successfully completes the following:

1. Names basic parts of micrometer.
2. Checks micrometer for accuracy.
3. Reads and records measurements.

DIRECTIONS TO THE STUDENT:

Provided access to a depth micrometer and several test pieces, the student will measure each piece and record the results following the steps listed below:

1. Name basic parts of micrometer.
2. Check micrometer for accuracy.
3. Read and record measurements.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:	Yes	No
1. Name the basic parts of the micrometer?		
2. Check micrometer for accuracy?		
3. Read and record measurements?		
4. Obtain correct readings?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

TASK: Take vernier caliper readings (dial or plain).

CRITERIA STATEMENT:

Student competence in taking vernier caliper readings will be recognized when the student successfully completes the following:

1. Names basic parts of the vernier caliper.
2. Checks vernier for accuracy.
3. Reads and records measurements.

DIRECTIONS TO THE STUDENT:

Provided access to a vernier caliper and several test pieces, the student will measure each piece and record the results following the steps listed below:

1. Name basic parts of the vernier caliper.
2. Check vernier for accuracy.
3. Read and record measurements.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:	Yes	No
1. Name the basic parts of vernier caliper?		
2. Check vernier for accuracy?		
3. Read and record measurements?		
4. Obtain correct readings?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

MACHINE TOOL

TASK: #D-10

TASK: Use of thread micrometer, comparator micrometer, and thread wires.

CRITERIA STATEMENT:

Student competence in using a thread micrometer, comparator micrometer, and thread wires will be recognized when the student successfully completes the following:

1. Reads thread micrometer.
2. Uses comparator micrometer correctly.
3. Selects and uses (3) wire method.

DIRECTIONS TO THE STUDENT:

Provided access to a thread micrometer, comparator micrometer, thread wires, and test screws, the student will measure each screw and record the results following the steps listed below:

1. Read thread micrometer.
2. Use comparator micrometer correctly.
3. Select and use (3) wire method.

STUDENT RESPONSE:

No student response space is required as the student will perform the task while being observed by the evaluator.

DIRECTIONS TO THE EVALUATOR:

Provide the student with the necessary equipment, manuals, or training aid needed to perform the task; then complete the following checklist:

Did the student:

	Yes	No
1. Read thread micrometer?		
2. Use comparator micrometer correctly?		
3. Select and use (3) wire method?		
4. Obtain the correct readings?		

EVALUATOR'S RESPONSE:

Satisfactory performance is indicated when all checks are "yes". If the student's performance was not satisfactory, cite below any significant reasons.

APPENDIX E

February 11, 1980, Workshop
Letters, Agenda, and Minutes

Blackhawk Technical Institute

CENTRAL FACILITY
Rt. 3, Prairie Road
Janesville, Wisconsin 53545
1-608-756-4121

C. L. Jenson
District Director

November 24, 1980

Dave Ziegler
Monticello High School
312 South Main
Monticello, Wisconsin 53570

Dear Mr. Ziegler:

Please mark your calendar for December 2, 1980, as to the date of the third Machine Tool Trades Articulation Meeting. We have identified one-half of the categories and the competencies for each, determined a rating scale, and have roughed in the major areas for the remaining half. Thank you all for a hardworking and extremely informative work session on November 12.

This meeting will be another work session to complete the record contents and to establish objectives and dates for a final meeting at which time advisory committee members will be invited to participate in the final review.

Don't forget, Tuesday, December 2, 1980, at Blackhawk Technical Institue, Beloit Campus at 5 P.M. Dinner will be again served by the Food Service Students. Please let us know by November 28 if you plan to attend.

Sincerely,

Esther Maier

Esther Maier
Curriculum Coordinator
Blackhawk Technical Institute

jr

MACHINE TOOL ARTICULATION

AGENDA

December 2, 1980 Blackhawk Tech

I. REVIEW OF COMPLETED COMPETENCY LIST

II. REVISION OF REMAINING COMPETENCY LIST

III. DECISIONS ON FINAL COMPETENCY RECORD FORMAT

IV. PLANS FOR FOURTH AND FINAL MEETING

V. CALENDAR OF COMING EVENTS

MINUTES

Articulation of Machine Tool Trades — December 2, 1980
Blackhawk Technical Institute-Beloit Campus

Members present:

Lloyd Edge	Clinton High School
Tom Skorpinski	Turner High School
Bill Jennings	Craig High School
John Schwalbe	Parker Senior High School
Bob Brown	Blackhawk Tech
Bill Peterson	Blackhawk Tech
Bob Housner	Blackhawk Tech
Harry Olsen	Blackhawk Tech
Harold Thomas	Blackhawk Tech
Esther Maier	Blackhawk Tech

The meeting opened with a review of the task list as revised in the November 12 meeting. Mr. Edge suggested that the items be put in a simple to complex order. All agreed and Bill Peterson and Esther Maier suggested that this process be done upon completion of the list and at Blackhawk before the next meeting. The revised rating scale was again reviewed and accepted.

Esther Maier asked that the group review the minutes of the last meeting for inclusion in a final report. The minutes stood as written. She then suggested that the same procedures be now used on the second half of the competency record as was used to determine the task list of the first half. The group agreed and went to work.

Mr. Edge suggested that, under the category, "Identify and Use Proper Measuring Tools," an item 11. be added: 11. Degree of finish. The group supported this addition.

In the second half, the group changed a category heading from "Identify Metals, Characteristics for Hardening & Tempering Processes" to "Identify Materials." Several items under this area were then transferred to the category "Heat Treat Metal."

Tasks in some cases were divided into more specific units. Others were added and some eliminated. New categories, "Tool Grinding", "External Grinding", "Surface Grinding", "Internal Grinding", "Planer", "HBM", "Vertical Turret Lathe", and "General Types of Machines", also "Turret Lathe","Shaper", and"EDM" were determined and specific tasks listed. After some discussion, it was decided to list machine types with space provided for the instructors to identify specific name brands as a means of better explaining the breadth and depth of a student's experiences in the shop.

Two categories were removed: "Communicate Technical Information" and "Interact With Employers and Employees", as neither area is specifically taught in connection with the shop activities. The latter also indicates attitudes and values and may be difficult to observe and evaluate. These aspects of training may be better recorded as voluntary comments on the part of each instructor. Perhaps a section for " Comments" could be indicated on the back of the record.

The group completed the record and agreed to then have the results typed into a sample record for the next and final meeting. This meeting will be held in the latter part of January or first of February, 1981, and each school represented will invite an advisory committee member to join the group for a final review and acceptance of the competency certificate.

The meeting was adjourned.

CLINTON COMMUNITY SCHOOL DISTRICT

Box Q

CLINTON, WISCONSIN 53525

ROBERT L. JENSEN, Superintendent

608-676-2223

December 3, 1980

Esther Maier
Curriculum Coordinator
Blackhawk Technical Institute
Route #3, Prairie Road
Janesville, Wisconsin 53545

Dear Ms. Maier:

Enclosed is a list of items we feel should be included in the machine operation evaluation list - NOT A TACK ON AS BILL INDICATED. The information will be very hard to include in the other spaces in terms of the number of items on this list.

I realize Clinton is an isolated case for turret and EDM machinery. Future growth for other high schools may well go this direction. Blackhawk Tech has the same problem.

Please let me know of any interaction you feel necessary in this matter.

Sincerely,

Lloyd Edge

Lloyd Edge

LE:bg

CLINTON ELEMENTARY SCHOOL
Box 70 - Clinton, WI 53525
George J. Kelak, Principal
608-676-2211

CLINTON JUNIOR HIGH SCHOOL
Box J - Clinton, WI 53525
Roger T. Noe, Principal
608-676-2276

CLINTON HIGH SCHOOL
Box Q - Clinton, WI 53525
Eugene H. Haraevoort, Principal
608-676-2223

Turret lathe

- Safe procedures
- Identify major parts
- Machining sequence
- Speeds and feeds
- Carbide tooling
- Square turret
- Rear tool post - cut off necking
- Bar turner
- Die head
- Slide tool - boring
- Adjustable knee
- Drilling
- Releasing tap holder
- Boring

Grinding

- Safe procedures
- Pedestal grinding
- Truing a grinding wheel
- Freehand grinding
- Surface grinding
- Truing a surface grinding wheel
- Set up procedure
- Cylindrical grinding
- Truing
- Set up
- Removing taper
- Centerless grinding

Shaper

- Safe procedure
- Tools
- Horizontal surface shaping
- Vertical surface shaping
- Cutting an external groove
- Cutting an internal groove
- Sharpen tools freehand - tool grinder

EDM

- Safe procedure
- Make tool
- Set up
- Machine cavity
- Flushing methods

Blackhawk Technical Institute

CENTRAL FACILITY
Rt. 3, Prairie Road
Janesville, Wisconsin 53545
1-608-756-4121

C. L. Johnson
District Director

January 19, 1981

Dear Dave:

The fourth and final Machine Tool Articulation Meeting will be held February 11, 1981, 6:00 P. M., at the Left Guard in Janesville. As you can see from the December 2, 1980, meeting minutes, the work has progressed nicely in developing an articulated competency record between the two levels of training. By the February 11 date, a sample certificate will be ready for your review and final critiquing.

This last meeting is one that will include our advisory committee members. They, too, will be able to observe the articulation process, the resulting certificate, and to take part in the decision making. Advisory members can offer insight and expertise which will expand the potential use of the certificate into the world of work. So, please invite at least one member of your advisory committee to attend with you on February 11. If you have no advisory group, invite a local machine tool trades area contact you may have that you feel would be a help to the articulation activity. Feedback from the community is of great importance in keeping our programs relevant and up to date.

May we have your confirmation on the February 11 meeting by returning the enclosed postcard before January 30. Thank you for your cooperation and consideration.

Sincerely,

Esther Maier

Esther Maier
Curriculum Coordinator

EM/gdf

Enclosure

AGENDA

MACHINE TOOL ARTICULATION
MEETING

February 25, 1981 Left Guard, Janesville

I. Welcome and Introductions

II. Review of Past Workshop Activities

III. Final Review of Revised Competency List

IV. Open Discussion to Finalize Activities

V. Career Awareness of Women in Machine Tool and Metals Occupation: Preparation of a slide-tape presentation.

VI. Confirmation of Articulation Efforts

Blackhawk Technical Institute

CENTRAL FACILITY
Rt. 3, Prairie Road
Janesville, Wisconsin 53545
1 608 756-4121

O. L. Johnson
District Director

Minutes

MACHINE TOOL ARTICULATION MEETING

February 25, 1981 — Left Guard- Janesville

Members Present:

John Schwalbe	Parker High School
Lloyd Edge	Clinton High School
Donovan Jones	Clinton High School
Tom Skorpinski	Turner High School
LaVonne Keitch	Beloit Memorial
Pat Inda	Marshall Junior High
Art Walker	Beloit Corporation
Ron Maschula	Beloit Corporation
Dave Ensminger	Gardner Machine
Dick Statton	Scott Forge
George Blue	Meyer & Margis Construction Co.
Frank Trafford	Blackhawk Tech
Harry Olsen	Blackhawk Tech
Harold Thomas	Blackhawk Tech
Bob Brown	Blackhawk Tech
Bill Peterson	Blackhawk Tech
Bob Housner	Blackhawk Tech
Esther Maier	Blackhawk Tech

The last meeting in the series of three articulation workshops began with introductions of those present as included in the group were advisory committee members from the various programs.

The first order of business was to discuss the possible need for a disclaimer statement to be added to the record as instructors have began to question the validity and responsibility on their part for compentency evaluations. It was suggested that legal counsel be sought to review the certificate and present wording for clarification on this matter.

Bill Peterson reviewed the work of the past two sessions. The competencies and the order of competencies stood generally as had been planned. The back of the record will be left blank and will be used at the discretion of each instructor or program. Blackhawk instructors indicated plans to include types

of equipment and possibly special comments. Hours of training time was suggested as an item of importance to employers in better understanding the type of training available. Both actual and possible hours should be listed. This data would be best included on the front of the record.

The record was then accepted and will be prepared for printing. Esther Maier explained that she will distribute the finished product to the schools hopefully before May 1. She also explained that the 15 minute slide-tape presentation to be developed as part of the articulation will be sent out as soon as it is completed. The slide-tape will feature women in machine tool and metals trades. It was suggested by the group that the career awareness aspect of the presentation might better be done at the junior high level as girls are beginning their studies in the high school level.

The meeting was adjourned.

dp

APPENDIX F

Finalized Competency Record

Machine Tool Competency Record

FOR

(Name)

THIS RECORD SHOWS THE CAPABILITIES ACQUIRED BY THE PERSON IN THIS INSTRUCTIONAL AREA. AS THE INDIVIDUAL GAINS COMPETENCY, THE INSTRUCTOR OR EMPLOYER WILL RATE THE LEVEL OF EACH SKILL BY INITIALING IT.

THE PERSON WILL CARRY THIS RECORD TO SUCCEEDING TRAINING INSTITUTIONS OR PROSPECTIVE EMPLOYERS AS A RECORD OF ACHIEVEMENT IN THE INSTRUCTIONAL AREA LISTED.

School(s) Attended/Employer	Phone No.	Dates Attended (From - To)	Hours: Actual/Required	Instructor's Signature

*This should not be considered a diploma or a transcript. If further information is desired, please contact the proper school for official records. If time has elapsed since previous ratings were made, retesting of the skills is advised.

RATING SCALE

NA - Not taught or no opportunity to observe

1 - Can perform some parts of the skill satisfactorily, but requires instruction and supervision to perform the entire skill.

2 - Can perform this skill satisfactorily without assistance and/or supervision.

IDENTIFY & FOLLOW SAFETY PROCEDURES: 0 1 2
1. Personal and protective attire
2. Potential shop hazards
3. Hand tools
4. Operating machines
Other

IDENTIFY & USE PROPER MEASURING TOOLS:
1. Terminology
2. Steel rule
3. Combination square
4. Calipers
5. Surface Gage
6. Micrometer caliper
7. Inside micrometer
8. Depth micrometer
9. Dial indicator
10. Vernier caliper
11. Vernier height gage
12. Telescoping gage
13. Small hole gage
14. Gage blocks
15. Comparator
16. Protractor
17. Adjustable parallels
18. Snap gages
Other

PERFORM HAND OR BENCH WORK OPERATIONS:
1. File
2. Cut threads with taps and dies
3. Deburr
4. Produce keys and other center heads
5. Geometric construction
6. Hand reaming
7. Sawing
8. Drilling
9. Broaching
Other

USE A MACHINIST HANDBOOK TO LOCATE TECHNICAL INFORMATION & MACHINING DATA:
1. Trade references
2. Machinist handbook index

SELECT & USE PROPER CUT-OFF MACHINES:
1. Safe procedures
2. Minor maintenance & adjustments
4. Bands and blades
5. Cut and weld band blades
6. Insert blades
7. Holding devices
8. Speeds and feeds
9. Coolants
10. Reciprocating
11. Horizontal band
12. Vertical band
13. Abrasive
Other

PERFORM BASIC DRILLING MACHINE OPERATIONS: 0 1 2
1. Safety procedures
2. Operate controls
3. Minor maintenance and adjustment
4. Speeds and feeds
5. Drills
6. Bit Parts
7. Spiral flute drilling
8. Spade drilling
9. Carbide drilling
10. Drill sleeves
11. Drill chucks
12. Floating holders
13. Coolants
14. Machine reamers
15. Hand reamers
16. Tapping
Other

PERFORM BASIC GRINDING OPERATIONS:
1. Safe procedures
2. Identify major parts of universal cylindrical grinder
3. Identify major parts of surface grinder
4. Pedestal grinding
5. Balance grinding wheel
6. Dress and true grinding wheel
7. Freehand grinding
8. Attach and align materials for grinding
9. Select and set speeds and feeds of power feed grinder
10. Set up and perform surface grinding operation
11. Set up and grind straight diameter on cylindrical grinder
12. Set up and grind tapered diameter on cylindrical grinder
13. Centerless grinding
Other

PERFORM BASIC VERTICAL MILLING MACHINE OPERATIONS: 0 1 2
1. Safe procedures
2. Identify major parts of machine and their function
3. Minor maintenance & adjustments
4. Power feed
5. Lock clamps
6. Speeds and feeds
7. Conventional milling
8. Climb milling
9. Install cutters
10. Position cutter
11. Align vise
12. Align workpiece
13. Clamping methods
14. Angular cutters
15. Woodruff cutters
16. Endmills
17. Indicate table in two planes
18. Offset boring head
19. Boring bar cutter
20. Plunge cutting
21. Side cutting
22. Face cutting
23. Millwork piece square
24. Locate hole centers
25. Horizontal attachment
26. Rotary table
27. Indexing head
28. Vertical head
29. Straddle mill
Other

PERFORM BASIC TURRENT LATHE OPERATIONS:
1. Safe procedures
2. Identify major parts of machine and their functions
3. Minor maintenance and adjustments
4. Machining sequence
5. Speeds and feeds
6. Square turret
7. Rear tool post - cuts off, necking
8. Stock stop and start drill
9. Bar turner
10. Die head
11. Side tool - boring
12. Adjustable knee
13. Drilling
14. Tapping - releasing tap holder
15. Overhead turning
16. Reaming
17. Multiple turning head
18. Vertical tool post
Other

IDENTIFY MATERIALS:

1 Select materials using reference handbook
2 Select materials using testing processes
3 Select various tool steels for appropriate use
4 Non ferrous metals and use as required
5 Low carbon and alloy steel for specific use
Other

PERFORM BASIC ENGINE LATHE MACHINE OPERATIONS.

1 Safety procedures
2 Operate controls
3 Minor maintenance and adjustment
4 Tool geometry
5 Spindle tooling
6 Tool holding device
7 Align centers
8 Drilling
9 Reaming
10 Boring
11 Tapping
12 Knurling
13 Threading
14 Thread chasing
15 Parting
16 Facing
17 Turning
18 Mandrel and arbor
19 Three jaw chuck
20 Four jaw chuck
21 Collets
22 Face plates
23 Soft jaws
24 Dead center
25 Ball type center
26 Grooving and undercutting
27 Form relieved
28 Internal taper
29 Taper by offset
30 Taper attachment
31 Taper by compound
32 Acme thread
33 Vee thread
34 Square thread
35 Steady rest
36 Follow rest
37 Carbide cutting tools
38 Speeds
39 Micrometer
40 Taper
41 High speed steel
42 Forming
Other

2. Identify major parts of machine & their functions
3 Minor maintenance & adjustments
4 Power feed
5 Lock clamps
6 Speeds and feeds
7 Conventional milling
8 Climb milling
9 Install cutters
10 Position cutter
11 Align vise
12 Align workpiece
13 Clamping methods
14 Angular cutters
15 Woodruff cutters
16 End mills
17 Indicate table at two planes
18 Offset boring head
19 Boring bar cutter
20 Side cutting
21 Side cutting
22 Face cutting
23 Mill work piece square
24 Locate hole center
25 Horizontal attachment
26 Rotary table
27 Indexing head
28 Vertical head
29 Straddle mill
Other

PERFORM BASIC HORIZONTAL BORING MILL OPERATIONS

1 Safe procedures
2 Identify
3 Minor maintenance and adjustments
4 Machining sequence
5 Speeds and feeds
6 Conventional milling
7 Climb milling
8 Face milling
9 Drilling
10 Boring
11 End mills
12 Align workpiece
13 Clamping methods
14 Angular cutters
15 Offset boring head
16 Boring bar
17 Locate hole center
18 Rotary table
19 Tapping releasing tap holder
20 Line boring outboard support
Other

Identify major parts of machine and their functions
3 Minor maintenance and adjustments
4 Machining sequence
5 Feeds and speeds
6 Operate controls
7 Side head turret
8 Ram turret
9 Drilling
10 Boring
11 Turning
12 Facing
13 Taper turning
Other

PERFORM BASIC SHAPER FUNCTIONS:

1 Safe procedure
2 Operate controls
3 Identify major parts
4 Minor maintenance and adjustment
5 Select, shape and sharpen cutting tools
6 Speeds and feeds
7 Vertical shaping
8 Horizontal shaping
9 Contour surfaces
10 Internal shaping keyway
11 External shaping keyway
12 Angular surface shaping
Other

PERFORM BASIC PLANER MACHINE OPERATIONS

1 Safe procedures
2 Identify major parts
3 Minor maintenance and adjustments
4 Select speeds and feeds
5 Select, shape and sharpen cutting tools
6 Horizontal planing
7 Vertical planing
8 Angular surface planing
Other

PERFORM BASIC (EDM) ELECTRO DISCHARGE MACHINING FUNCTIONS

1 Safe procedures
2 Identify major parts
3 Minor maintenance and adjustment
4 Select proper discharge circuit
5 Select dielectric flushing fluid
6 Proper electrode material
7 Machine an electrode
8 Set up desired metal removal rate
9 Machine cavity
Other

REMARKS

PERFORM BASIC NUMERICAL CONTROL FUNCTIONS 0 1 2

1 Apply axial moves on machine tools
2 Select tape materials
3 Identify standard tape codes
4 Identify standard tape readers
5 Perform tape prep function
Other

TOOL GRINDING

1 Hand grind lathe turning tool
2 Milling cutters
3 Drills
4 Brazed tooling
5 End mills
6 Plain mills
7 Countersinks
8 Slab mills
9 Stagger tooth milling cutter
Other

HEAT TREAT METAL

1 Safety procedures
2 Heat treatment requirements
3 Temperature and treating sequence from reference materials
4 Hardening
5 Tempering
6 Annealing
7 Normalizing
8 File test
9 Grind test
10 Brinell test
11 Rockwell test
12 Shores test
13 Vickers test
Other

READ BLUEPRINTS & USE SKETCHING TECHNIQUES 0 1 2

1 Use basic instrument and line technique according to ANSI standards
2 Use readable lettering
3 Apply basic geometric construction to job required
4 Use ortho graphic projection techniques
5 Apply basic dimensioning techniques using symbols, terms notes and specifications
6 Use sectional views
7 Use auxiliary views
8 Sketching techniques related to machine tool operations based on layout methods
Other

PERFORM MATHEMATICAL CALCULATIONS

1 Add, subtract, multiply and divide common fractions
2 Add, subtract, multiply, divide decimal fractions
3 Percentage ratio proportion
4 Determine square root of numbers from table
5 Use Pythagorean theorem in calculating sides of a right triangle
6 Identify geometric points, planes, and angles
7 Compute the areas of common geometric shapes
8 Apply basic geometric constructions that are used in machine tooling
9 Apply basic shop formulas
10 Use the six trigonometric rates
11 Translate and apply trigonometric function tables
12 Apply six trigonometric ratios in solving right triangles
13 Metric conversion
Other

APPENDIX G

Machine Tool Trade Slide-tape Script

NARRATION OF
MACHINE TOOL TRADE SLIDE-TAPE SCRIPT

NOW, MORE THAN EVER THE IMAGE OF THE WOMAN IN THE JOB FORCE IS UNDERGOING MAJOR CHANGES. WOMEN ARE NOW WORKING THEIR WAY INTO MANY NEW NON-TRADITIONAL JOBS. WITH THE NEW TECHNOLOGIES OF TODAY, MANY NEW JOB OPENINGS ARE BEING CREATED, ALLOWING WOMEN TO WORK IN A VARIETY OF NEW FIELDS.

TODAY IT'S BECOMING AN ECONOMIC NECESSITY FOR MANY WOMEN TO SEEK EMPLOYMENT. IT HAS BEEN RESEARCHED THAT WOMEN WORK, EVEN IF MARRIED AT LEAST 25 YEARS OF THEIR LIFE. APPROXIMATELY 53% OF ALL WOMEN WORK AT THE AGE OF 18. WHAT THIS ILLUSTRATES IS THAT GIRLS IN HIGH SCHOOL SHOULD BEGIN TO MAKE IMMEDIATE DECISIONS CONCERNING THEIR WORK FUTURE. HIGH SCHOOL IS A TIME TO FORM FRIENDSHIPS AND TO PREPARE THE STUDENT FOR THE FUTURE, WHATEVER DIRECTION THEY MIGHT TAKE. BUT IT IS THE STUDENT WHO HAS TO MAKE THE DECISION FOR THEMSELVES. AND, THE DECISION THAT THE STUDENT MAKES NOW WILL EFFECT THEIR FUTURE EMPLOYMENT PICTURE QUITE DRAMATICALLY. WHETHER A STUDENT PLANS TO TAKE A JOB OF A LESSER SKILL AFTER GRADUATION OR CONTINUE ON IN EDUCATION, A RESPONSIBLE DECISION IS NECCESARY.

ONE AREA YOUNG WOMEN SHOULD CONSIDER IS THAT OF NON-TRADITIONAL EMPLOYMENT IN THE MACHINE TRADES. A NEW FIELD FOR WOMEN, IT OFFERS GREAT POTENTIAL, BOTH IN SALARY AND ADVANCEMENT. MORE AND MORE WOMEN ARE NOW TRAINING TO WORK IN THIS FIELD.

FOR MANY WOMEN, ONCE INVOLVED IN THE MACHINE TRADES, THEY FIND AN EMPLOYMENT SETTING WHICH THEY LIKE AND ENJOY....

"IT IS RATHER ENJOYABLE....(A WOMAN TALKING ABOUT JOB SECURITY AND JOB ENJOYMENT) ....NOT GENDER"

HAVING WOMEN WORKING IN AN AREA WHICH USED TO BE STRICTLY ASSOCIATED WITH MEN MAY RAISE SOME PROBLEMS. WOMEN LEARN TO WORK WITH MEN, AND MEN LEARN TO WORK WITH WOMEN. A NEW EMPLOYMENT ATMOSPHERE IS CREATED AND A NEW WORKING RELATIONSHIP HAS TO BE ESTABLISHED.

"THERE ARE SOME PROBLEMS....(WOMEN TALKING ABOUT WORKING RELATIONSHIPS WITH MEN AND WOMEN) ....IT IS INTERESTING"

IT IS IMPORTANT TO PREPARE ONESELF BEFORE ENTERING THE MACHINE TRADE FIELD. TAKING SPECIFIC COURSES IN HIGH SCHOOL WILL BE OF GREAT VALUE FOR FUTURE EMPLOYMENT. IT IS THROUGH A VOCATIONAL/TECHNICAL THAT MANY INDIVIDUALS ARE OBTAINING THE NECESSARY TRAINING FOR A VARIETY OF JOBS.

"YOU HAVE TO TAKE TRAINING....(A WOMAN TALKING OF THE IMPORTANCE OF TECH SCHOOL TRAINING)....TOP WAGES"

SOME WOMEN ALREADY HAVE A SENSE OF DIRECTION AS TO WHERE THEY ARE HEADED IN THEIR EMPLOYMENT GOALS. THEY HOLD AN IMPORTANT ADVANTAGE OVER THOSE INDIVIDUALS WHO ARE UNDECIDED ABOUT THEIR FUTURE.

"I GOT INTO IT BY....(A WOMAN SAYING SHE GOT STARTED WITH AN APTITUDE TEST)....BEAUTICIAN WORK LOTS HARDER, IT REALLY IS".

AGAIN, IT'S IMPORTANT TO TAKE SPECIFIC COURSES WHEN IN HIGH SCHOOL. BY DOING THIS, THE WOMEN WORKERS WILL BE MUCH BETTER PREPARED FOR A CAREER IN MACHINE TRADES.

"TAKE AN INTEREST IN MATH....(A WOMAN TALKING ABOUT WOMEN ON THE JOB IN MACHINE SHOPS)....BIGGEST THING LIFTED WAS 3-4 POUNDS".

CONCLUSION:

THE EMPLOYMENT FUTURE FOR WOMEN TODAY HAS MUCH GREATER POTENTIAL THAN EVER BEFORE. AS NEW TECHNOLOGIES DEVELOP, MORE SPECIALIZED AND TECHNICAL TRAINING WILL BE REQUIRED. FOR THE WOMAN WHO PLANS HER FUTURE EMPLOYMENT GOALS EARLY, A REWARDING CAREER IS LIKELY. VOCATIONAL EDUCATION IS HERE TO PROVIDE THE NEW WOMAN EMPLOYEE WITH THE SKILLS NECESSARY FOR TOMORROW'S JOBS. ABOVE ALL, NOW IS THE TIME TO MAKE YOUR TIME COUNT.

APPENDIX H

Minutes of Joint Meeting Blackhawk
Tech Advisory Commitees Machine Tool
Operator and Machine Maintenance Programs

Blackhawk Technical Institute

CENTRAL FACILITY
Rt. 3, Prairie Road
Janesville, Wisconsin 53545
1-608-756-4121

O. L. Johnson
District Director

DATE: May 4, 1981

TO: Esther Maier

FROM: William E. Peterson
Machine Shop Instructor
Robert L. Brown
Machine Maintenance Instructor

Dear Sir:

Minutes of the Machine Tool Operator and Machine Maintenance Advisory Committees.

A meeting of these advisory committees was held on Tuesday, April 21, 1981 at 2:00 P.M. at the Blackhawk Technical Institute, central campus, by acting chairperson Wm. Peterson for vacationing chairman Mr. Ronald Machula.

Committee Members (Machine Tool Operator)

Marlin M. Severt
Stewart K. Martin
David Danielson
Jack Klopfenstein- excused
Ronald L. Machula- excused

Committee Members (Machine Maintenance)

Robert Cook
Arthur Walker
Wayne Olsen
David Huddleson
Bert Mills

Consultants

William E. Peterson - Machine Shop Instructor
Robert L. Brown - Machine Maintenance Instructor
Robert Housner - Machine Shop Instructor
Frank R. Trafford - Trade and Industry Chairman

Ester Maier - Curriculum Coordinator
Harold Thomas - Area Coordinator

The joint committees reviewed copies of the Machine Tool Competency Record packet, recently produced through joint effort of articulation with area high school instructors, Blackhawk Technical Institute and area industrial personnel. Bill Peterson explained that the report card concept will start in High School, travel through Blackhawk Tech. Institute; be up dated and then forwarded via the Machine Tool graduate to his future employer.

Robert Brown informed the committees that a competency record is presently being developed and finalized for the Machine Maintenance program and that the format will be similar to the Machine Tool Competency Record.

Bill Peterson pointed out that the comptency record is not a diploma nor an official transcript and that the proper school would have to be contacted for the official records. The ratings are most accurate at the time of rating and employers may wish to retest prior to employment if an extended period of time has lapsed.

Mr. Marlin Severt raised the question if the machine shop was considering purchasing related equipment and training students in the use of air gaging. It was felt that the school should explore the possibility of research in this area.

Mr. Art Walker pointed out that they were presently operating a number of machines with C.N.C. systems. He suggested that the machine shop investigate a numerial control turning machine of an older series, "hard wired" which would meet the training requirements of machine tool operators and machine maintenance students. Mr. Walker also pointed out the crying need for both N.C. operators and N.C. repair personnel.

Mr. David Danielson stated that their company has numerical control and computer numerical control and that maintenance/repair of equipment is a complex problem. He also noted that repair personnel needs to be an electronic specialist as well as mechanical and electrical repair man.

Some discussion centered upon the need for a strong basic math program to supplement the development of a trade skill. The need for educational training in metrics was discussed but the industrial concept is to use the inch system and convert to metric measurement as required.

The meeting adjourned at 3:20 P.M.

Sincerely